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# PATENT SPECIFICATION

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DRAWINGS ATTACHED

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## (54) METHOD OF FORMING PIPE JOINT

(71) We, CIBA-GEIGY A.G., (formerly known as Ciba Limited), a body corporate organised under the laws of Switzerland, of Basle, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an improved method for forming joints between pipes or between a pipe and a pipe fitting and is more particularly concerned with a method of joining thin wall plastics pipes in proper alignment without substantially reducing the strength of the pipe.

There are various methods which can be employed to make pipe joints. One of the more widely used methods is to cut threads into the outer wall of the pipe and then make the joint by screwing the threads into a fitting having mating internal threads. Another common method to make pipe joints is to bond the pipe and pipe fitting together. This may be done by using solder, as in the case of copper pipes, or by the use of resinous adhesives, as when joining plastics pipes.

The methods heretofore employed had several disadvantages, especially when joining thin wall pipe. Initially it should be noted than in order to have a satisfactory joint using threads, the threads must be of a sufficient depth so that a strong joint will be formed. When a deep thread is cut into the wall of a pipe, the strength of the pipe is somewhat reduced. Of even more importance, if the walls are relatively thin, there may not be a sufficient thickness to provide a thread having a sufficient depth to make a strong joint.

For the above reasons, among others, threaded joints are not generally used to join thin walled pipe, but rather the joints are generally made by bonding an elongated end portion of the outer wall of the pipe to a mating portion of a suitable fitting with a bonding agent. This method, however, has not proven to be completely satisfactory. Most bonding agents when applied are in a liquid state. In the liquid state they are not only poor adhesives, but they may also act as lubricants which can cause the joints to slide apart. Furthermore, using the adhesive method of joining, considerable difficulty is encountered in accurately aligning the fitting and the pipe and keeping the joint in alignment during the time when the adhesive sets.

In recent years there has been a substantial increase in the use of plastics pipes in industrial applications. Typical of the industries in which a plastics pipe is being extensively used is the oil industry. The pipe generally employed in this industry is of the laminated fiberglass reinforced epoxy type. Pipe of this type is strong and light in weight and is resistant to most chemicals and other types of damage.

When installing pipe systems it is preferable to install the pipe in a more or less continuous process, moving from joint to joint. It is somewhat impractical to wait until each joint has fully set because of the time involved. It is also impractical to continue making the joints and then doubling back to check to see if all of the joints previously made set in the proper position. It is especially advantageous to join the pipe in a continuous manner when installing underground pipe systems, for example, as in an oil field. The trench for the pipe is dug and the pipe is joined and laid in the trench. It would be highly desirable to immediately back fill the trench and continue the operation. However, using the prior art adhesive methods of joining the pipe, this was not a safe procedure. The bonding agent, as noted above, not only failed to lock the joints in place, but could, in fact, act as a lubricant to cause the joint to come apart before the adhesive set. The inherent

movements of the pipe during installation tended to make the pipe come apart. In addition, back filling of the dirt into the trenches also tended to cause the joints to come apart. Even if the pipe did not come completely apart, there was a strong tendency for the joints to become misaligned. This had the effect of restricting the flow through the pipe and weakening the joint.

The use of fast curing adhesives was suggested to overcome the above problems. However, this did not prove to be satisfactory in that the relatively short pot life of these adhesives made them impractical for use in commercial applications. In addition, the extremely fast cures were not desirable in that they complicated the installation of the pipe since minor changes in the alignment of the fittings shortly after installation could not be made without destroying the joint since the adhesive cured so fast. It is well known that it is of great advantage to have a small amount of play in the pipe joints for a while after the pipe is initially installed so as to be able to compensate for certain minor difficulties which may be encountered in the installation of the pipes.

According to this invention therefore we provide a method of making a joint between pipes or between a pipe and a fitting such as a T, L or Y piece or socket comprising, moulding and bonding male engaging means onto the outer surface of a first pipe at a predetermined distance from one end thereof, and moulding and bonding a female engagement means onto an internal bore of a fitting or socket or one end of a second pipe, the part of the internal bore of the fitting, socket or second pipe being shaped to engage said one end of said first pipe, which is coated with a bonding agent so as to bond with said internal bore whilst being held in position by engagement of the male and female means.

In the drawings:

Figure 1 is a partial cross sectional illustration of an end portion of a length of pipe.

Figure 2 is a partial cross sectional illustration of the pipe shown in Fig. 1, having an end cap.

Figure 3 is a partial cross sectional illustration of the pipe shown in Fig. 1 having an external thread.

Figure 4 is a partial cross sectional illustration of the bell on the end of a length of pipe.

Figure 5 is a partial cross sectional illustration of the pipe shown in Fig. 4 having a plug inserted in the bell portion.

Figure 6 is a partial cross sectional illustration of the pipe shown in Fig. 4 having an internal thread in the bell portion.

Figure 7 is a partial cross sectional illustration of a pipe fitting suitable for employment in the present invention.

Figure 8 is a partial cross sectional illustration of a bell and spigot joint formed according to the method of the present invention.

In describing the preferred embodiments of the invention illustrated in the drawings, specific terminology will be resorted to for the sake of clarity. However, it is not intended to be limited to the specific terms so selected, and it is to be understood that each specific term includes all technical equivalents which act in a similar manner to accomplish a similar purpose.

Turning now to the specific embodiments of this invention selected for illustration in the drawings, the number 10 denotes an end of a length of pipe on the end of which a taper 12 has been cut. The pipe 19 may be made of any of the usual materials employed in the manufacture of pipes. However, the present invention is especially useful when the pipe is made of plastics, for example, fiberglass reinforced epoxy. The taper 12 is not an essential feature of the present invention. However, it is of considerable advantage to cut a slight taper on the end of the pipe.

The pipe joint of the present invention is held together with a bonding agent. In order to insure that a strong bond is formed between the pipe and the fittings, the surface of the pipe to which the bonding agent is to be applied should be abraded to provide a roughened surface. This is especially true when using a plastics pipe, which has a smooth, glossy outer surface. The cutting of a taper on the pipe, in addition to making it easier to assemble the pipe and making tighter joints, also abrades the surface of the pipe to which the bonding agent will be applied. The degree of taper need not be large, with tapers of 1 to 2° being quite satisfactory.

The length of the pipe which is prepared to receive the adhesive can be varied over wide limits, depending on the size of the pipe. In practice it has been found that the length of pipe which is prepared for the adhesive should be between 1 and 2 times the diameter of the pipe in order to insure a strong joint.

A male thread 14 is molded onto the outer surface of the pipe 10. The thread 14 may be molded onto the pipe in any of the known manners. The thread 14 is positioned behind the portion of the pipe to which the bonding agent will be applied.

It has been found that one of the simplest and most economical methods for molding the thread 14 onto the pipe 10 is to adhere a cap 16 to the end of the pipe with a hardenable material. Pipe is generally supplied in given lengths from the factory. A cap is

applied to the ends of the pipe to protect the ends of the pipe from damage during shipment. The cap which is illustrated in Fig. 2 has a closed end, internal threads 18 near its open end and has an internal configuration substantially mating the outer configuration of the pipe 10. The cap may be secured to the end of the pipe 10 and the thread 14 molded onto the pipe simultaneously by applying an amount of a hardenable material such as an epoxy resin which will fill the thread portion 18 of the cap 16. The cap 16 with the hardenable material is then slipped onto the end of the pipe 10 so that the terminal end of the pipe 10 is immediately adjacent the closed end of the cap 16 and the hardenable material is allowed to harden and take the shape of the thread 18. The cap 16 should be made of either a material to which the hardenable material will not adhere, for example, polyethylene or polypropylene, or should have a release coating on its inner surface, for example, a silicone coating. The hardenable material should cure fairly quickly and must adhere selectively to the surface of the pipe but not to the cap.

It can be seen that, once the adhesive hardens and takes the shape of the threads 18 of the cap 16, the cap is held onto the end of the pipe by the thread 14 which is attached to the surface of the pipe 10. The cap 16 can be readily removed before assembly of the joint to expose the end of the pipe prepared for the adhesive and the external thread 14 which is molded onto the surface of the pipe.

When a length of pipe 20 is to be supplied with a bell 24 at its end, the bell 24 may be formed simultaneously with the pipe 20 as shown in Fig. 4, or the bell may be formed separately and then attached to the end of the pipe.

The inner wall 26 of the bell 24 has a configuration which substantially mates with the outer wall of the end of the pipe 10. The angle of taper of the inner wall 26 is substantially the same as the angle of the taper 12 cut on the end of the pipe 10. If a taper were not cut on the end of the pipe, the inner wall 26 of the bell would likewise be untapered mating the end of the pipe. The length of the bell taper is somewhat longer than the length of the taper on the pipe since threads 28 will be molded into the end portion of the bell 24. The threads 28 may be formed in a manner similar to the method employed to form the threads 18. A plug 30 having male threads 32 cut into its surface is coated with a hardenable material such as an epoxy resin in an amount sufficient to fill the space between the wall 26 of the bell 24 and the plug 30, and then the plug 30 is inserted into the bell 26 and the hardenable material is allowed to harden. The threads 28 are thus molded between the plug 30 and the wall of the bell 24. The plug 30 should be made of a self-releasing material similar to the material used to make the cap 16. The plug 30 is removed to expose the female thread 28. The threads 14 and 28 and the shape of the exterior of the pipe 10 and the interior of the bell 24 are of a substantially mating configuration.

It should be noted at this point that the present invention is not limited to bell and spigot joints but can be used to make other types of joints using other types of fittings such as T, L, Y or 45° piece or a socket These joints can be formed in a similar manner to the bell and spigot joint if the fittings have female threads and internal configurations which mate the male threads and exterior configurations of the pipe to which they are to be joined.

In addition, it should be noted that it may be of some advantage in making fittings, and even making lengths of pipe with bells, to mold the threads directly to the wall of the fitting during manufacture rather than using the plug method described above to obtain the threads.

In Fig. 7 there is shown a socket 34 which has been molded with the threads 36 which have been formed directly into the walls 38 of the socket 34. This method is especially useful in the manufacture of fittings if the fittings are formed over shaped mandrels since this method does not significantly increase the cost of forming the fittings.

The method of forming a pipe joint in accordance with the present invention is quite simple. The protective caps 16 and plugs 30, if any, are removed by screwing them off. The bonding agent, for example, an epoxy resin, is applied to the length of pipe which has been previously prepared for the adhesive. In the case of pipes having a taper 12, the bonding agent is applied to the taper. The bonding agent may also advantageously be applied to the whole length of pipe from the terminal end of the pipe to the start of the molded threads. The pipe 10 with the bonding agent applied is inserted into the bell 24 and the threads 14 and 28 and engaged and screwed together. As the male and female portions are screwed together, the joint is simultaneously aligned and then held in proper alignment during the time in which the bonding agent cures by the threads 14 and 18. In Fig. 8 a bell and spigot joint 40 is shown. However, it is to be understood that the present invention is not limited to bell and spigot joints, but includes all pipe joints formed in a similar manner. A bond is formed between the pipe and the fitting when the

bending agent cures, and it is this bond which seals and holds the pipes together in actual use.

The advantages of this method are many. One is that the threads 14 and 18 hold the pipe in proper alignment during mating and prevent the ends from slipping about before the bonding agent sets. This permits the continuous installation of pipe systems, including back filling of trenches before the pipe joints have completely set, since the joints will not come apart during normal installation conditions due to the presence of the locking threads. In addition, it is important to note that the process of the present invention is especially useful for joining thin wall pipes. The threads are molded onto the pipe, not cut into the walls of the pipe. The depth of the thread necessary to hold the pipe joints together during the setting of the bonding agent is obtained without reducing the strength of the pipe, and in fact, the molded threads may even slightly increase the wall strength of the pipe near the joint. The simplicity of forming the threads by applying a protective cap 16 having threads cut into its surface along with an adhesive which will harden to form the threads is a substantial advantage in manufacturing processes since the thread is readily formed in this manner and the protective caps or plugs are then held securely in place and protect the pipe until they are removed immediately before installation of the pipe.

The shape of the threads can readily be changed or locking lugs may be employed, instead of threads or other such expedients which operate in a similar manner to accomplish a similar purpose.

It should be further noted that, while the use of the cap 16 and the plug 30 to mold respectively the threads 14 and 28 is the preferred method, other molding means can also be employed to form the threads. For example, to form the male thread on the outer wall of the pipe, an annular mold can be provided having an inner wall configuration substantially mating the outer wall of the pipe and having a female thread defined in the inner wall thereof. This female thread can then be filled with a hardenable material which is selectively adhesive to the wall of the pipe when in the hardened condition. The molding means, that is, the annular mold with the hardenable material in the female threads, is then slipped over the end of the pipe and positioned on the pipe at said predetermined length from the end of the pipe, and the hardenable material is allowed to harden and adhere to the surface of the pipe, whereupon the annular mold is removed and may be used over to form additional threads on other lengths of pipe.

A similar means can be employed to form the female thread in the fittings. A mold member is provided which has an exterior configuration substantially mating the interior configuration of the fitting and having defined on its outer walls thereof a male thread. The male thread portion is filled with a hardenable material which is selectively adhesive to the material comprising the fitting, and the mold member is inserted into the fitting. The hardenable material is allowed to harden in place, whereupon the hardenable material selectively adheres to the fitting and takes the form of the male thread of the mold member. The mold member may then be removed and used to make additional female threads in other fittings.

WHAT WE CLAIM IS:—

1. A method of making a joint between pipes or between a pipe and a fitting such as a T, L or Y piece or socket comprising, moulding and bonding male engaging means onto the outer surface of a first pipe at a predetermined distance from one end thereof, and moulding and bonding a female engagement means onto an internal bore of a fitting or socket or one end of a second pipe, part of the internal bore of the fitting, socket or second pipe being shaped to engage said one end of said first pipe, which is coated with a bonding agent so as to bond with said internal bore whilst being held in position by engagement of the male and female means.

2. A method as claimed in Claim 1, wherein said male engaging means and said female engagement means are corresponding mating threads.

3. A method as claimed in Claim 1, wherein said male engaging means comprises lugs and said female engagement means are arranged to receive said lugs.

4. A method as claimed in Claim 1, 2 or 3 wherein said fitting is a bell attached to a length of pipe, said female engagement means being moulded into said bell.

5. A method as claimed in any one of the preceding Claims, wherein said first and second pipes and said fitting have thin walls made of plastics material.

6. A method as claimed in Claim 5, wherein the other surface of said one end of said first pipe is abraded prior to application of said bonding agent.

7. A method as claimed in Claim 5 or Claim 6, wherein said one end of said first pipe is tapered.

8. A method as claimed in any one of the preceding claims wherein said bonding agent is a curable resinous material, and said pipes and said fitting are made of material which bonds with said bonding agent.

9. A method as claimed in Claim 2,

wherein said male thread is moulded on said first pipe by providing a cap having a closed end, an open end and an internal wall configuration which substantially mates the external shape of said first pipe and in which a female thread is formed at said predetermined distance from said closed end; applying an amount of a hardenable material to said cap which is sufficient to fill said female thread, said hardenable material being selectively adhesive to the surface of said first pipe when hardened; inserting the end of said first pipe into the open end of said cap and positioning said cap so that the terminal end of said first pipe is immediately adjacent said closed end of said cap, maintaining said cap in this position until said hardenable material hardens, whereby said male thread is moulded onto the surface of said first pipe at said predetermined distance from the terminal end of said pipe.

10. A method as claimed in Claim 2 in which the male thread is moulded onto the outer surface of said first pipe by providing an annular mould means having an internal wall which substantially mates with the outer surface of said first pipe and having formed in the internal wall a female thread; filling said female thread with a hardenable material which when hardened is selectively adhesive to said outer surface of said first pipe; inserting said first pipe into said mould; allowing said material to harden while said mould is in place on said pipe, whereby said male thread is moulded onto said outer surface.

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1255413 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

Fig. 1.

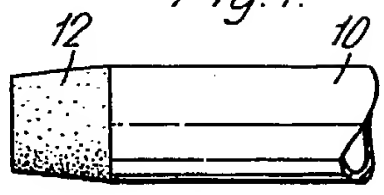


Fig. 2.

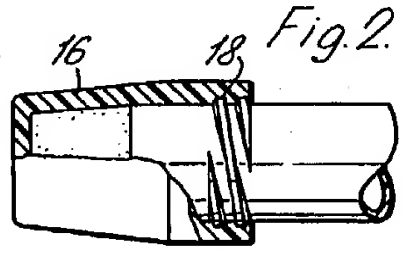


Fig. 3.

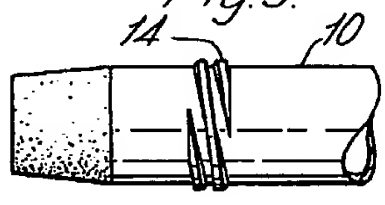


Fig. 4.

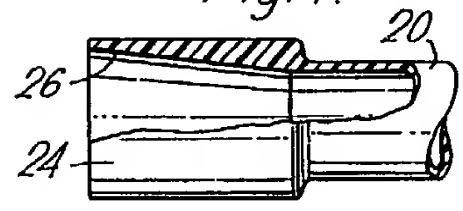


Fig. 5.

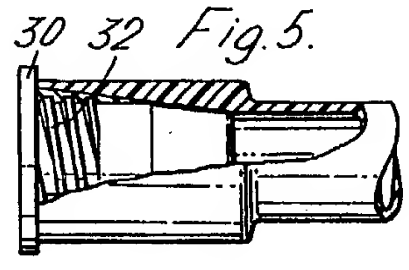


Fig. 6.

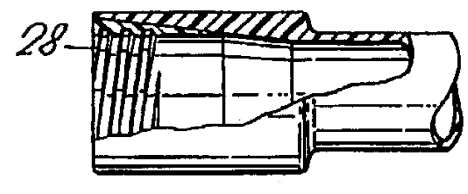


Fig. 7.

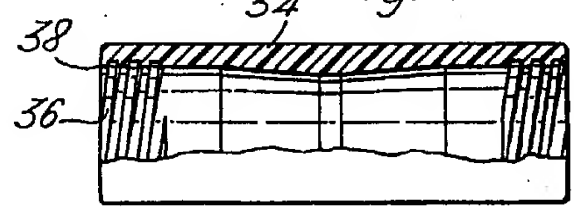


Fig. 8.